

placed by Schultz and his associates upon the role of tetracycline plays in the hepatic changes.

Recently Searcy and coworkers<sup>8</sup> demonstrated depression of beta lipoprotein levels in patients during short-term tetracycline infusions. This could conceivably be related to the known effect of interference with protein synthesis by this drug.<sup>3,11</sup> The pathologic changes observed in the liver and kidneys may be a morphologic expression of this phenomenon. Although Schultz and coworkers stressed the hepatic alterations occurring in their patients, it is felt that the renal changes observed in the present case are also noteworthy and may indeed be responsible for a significant portion of the clinical and biochemical abnormalities described.

The extensive clinical studies of Shils<sup>11</sup> on the metabolic effects of tetracycline have shown that this agent exerts an "anti-anabolic" effect. The apparent enhancement of this effect by estrogen (Shils' Case A4, Table 6), and, conversely, the suppression of this effect by androgen, leads us to suggest that the toxic effects of tetracycline, as manifested in these patients may be more pronounced in women, especially during gestation. The present case tends to support this concept. However, further clinical and experimental studies will be necessary to elucidate this relationship, if indeed it truly exists.

## Summary

Hepatic and renal lesions observed at necropsy in a castrated man who had received estrogen therapy over a long period were believed to be secondary to the parenteral administration of tetracycline. It is postulated that they may represent a morphologic expression of the interference with protein synthesis on the part of this drug. An important modifying influence by gonadal hormones is suggested.

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# Abdominal Aortic Aneurysm with Rupture into the Inferior Vena Cava

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THE SPONTANEOUS RUPTURE of an arteriosclerotic abdominal aortic aneurysm into the inferior vena cava is considered a rare condition although in the past few years reports have been appearing more frequently in the literature.<sup>2,3,4,6</sup> Eleven cases of this condition, successfully treated surgically, were recently reported by Beall and associates, who reviewed the world literature at that time.<sup>2</sup> Two additional cases were reported by Darling and Linton<sup>3</sup> and this paper is concerned with what is believed to be the 14th surgically treated case with survival.

## Report of a Case

A 62-year-old white man was admitted to the Los Angeles County General Hospital Unit II on June 11, 1963, with the complaint of lower abdominal pain radiating to both testes and both flanks for approximately 12 hours. The patient said that for two months previously he had been aware of an abdominal "pulsation." In 1960 he had had suprapubic prostatectomy.

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On physical examination, facial rubor was noted. The blood pressure was 110/80 mm of mercury, respirations were 28 per minute and the pulse rate 130. A grade II apical systolic murmur was present. The lungs were clear. An abdominal pulsatile mass, tender to palpation, was clearly visible in the region of the umbilicus. On auscultation a systolic bruit was heard in the mass. The liver and spleen were not enlarged. An old midline infraumbilical scar was present. Both femoral pulses were present but only the right popliteal pulse could be felt. The dorsal pedis pulses were absent bilaterally. In both lower extremities, which were mottled and cold, venous distention and slight edema were noted.

The packed cell volume was 40 per cent. Leukocytes numbered 8,500 per cu mm—76 per cent segmented forms, 4 per cent stabs, 17 per cent lymphocytes, 2 per cent basophils and 1 per cent eosinophils. The blood urea nitrogen was 24 mg per 100 ml.

With the patient under general endotracheal anesthesia, a long left paramedian rectus muscle-splitting incision was made in the abdomen. The small bowel and colon were lifted through the abdominal opening and a large pulsatile aneurysmal mass extending from just below the renal arteries down to the bifurcation of the aorta was observed. The distal duodenum was adherent to the upper portion of the mass. The aorta just distal to the renal arteries and then both common iliac arteries were cross-clamped and the aneurysmal sac was opened. On evacuation of a large clot, profuse bleeding occurred through the opening in the sac, and on digital exploration a large aorta-caval fistula, approximately 4 to 5 cm long was felt between the aortic aneurysm and the proximal inferior vena cava. The distal portion of the left common iliac vein was also involved in the communication. When attempts to close the opening in the cava and iliac vein were unsuccessful, these structures were clamped above and below the fistula and were oversewn, a portion of the aneurysmal wall being utilized in the repair. The major portion of the aortic aneurysm, including the area in contact with the duodenum, and a section of the vena cava were then resected and an aortic bifurcation graft of crimped Teflon® was placed between the proximal abdominal aorta and the common iliac arteries. The posterior parietal peritoneum was not closed. The abdominal wound was closed in layers and retention sutures were placed. The patient received 7,000 ml of blood during the procedure.

Postoperatively, the patient remained in fair condition but pronounced oliguria developed. In the first 12 hours after the operation only 230 ml of urine had been collected and the hourly output had dropped to about 10 ml. The blood urea nitrogen

was 43 mg per 100 ml. At this time the patient was given 200 ml of a 25 per cent solution of mannitol (50 gm) mixed with 300 ml of 5 per cent dextrose in water intravenously over a two-hour period. Profuse diuresis ensued and the output of urine in the next eight hours was 725 ml. Once the episode of transient renal failure was past, the patient did well. He was eating and walking by the third day. On the ninth day the blood urea nitrogen was 20 mg per 100 ml and the patient was without complaints. Preparations were made for discharge the following morning.

Next day, however, during the morning ward rounds, both of the lower extremities were observed to be cold and mottled. There was no palpable left femoral pulse and the pulse on the right side was diminished. Thrombotic occlusion of the graft was suspected but at operation the Teflon graft was found to be working well without evidence of occlusion. Groin incisions were made bilaterally and complete occlusion of the superficial left femoral artery was noted. The superficial right femoral artery was patent but the pulse was diminished. Direct arteriography confirmed the conditions observed surgically and also revealed narrowing of the right popliteal artery. A long incision was made in the left superficial femoral artery and a large clot was extracted. The opening was closed with 6-0 arterial silk. The groin incisions and the abdomen were then closed.

Following this operation the patient again had a transient episode of oliguria which again responded to an infusion of mannitol. The left foot remained somewhat cooler than his right. Heparin and antibiotics were administered and the patient gradually improved. Except for a mild wound infection in the left groin, recovery was excellent. The patient was discharged from the hospital on July 23, 1963.

Left foot pain associated with increasing arterial insufficiency necessitated readmitting the patient to the hospital on August 10, 1963. The left groin incision had healed and the left femoral artery could be palpated easily. The left popliteal pulse, however, was not palpable and there was blackening of the fourth and fifth toes. Because of these irreversible ischemic changes, left mid-thigh amputation was performed on August 20, 1963.

Three days before the amputation an increasing pulsatile mass 4 cm in diameter was palpable in the left groin. This was felt to be a pseudo-aneurysm of the left arm of the graft and it was not explored at the time of the amputation for fear of interrupting blood supply to the left thigh stump. The intent was to explore the left groin after primary healing had occurred. Late in the evening of August 21, 1963, the aneurysmal mass in the left groin ruptured, creating a large dissecting hematoma over the en-

tire left flank. The patient was in shock. Blood transfusions were started, the left groin incision was reopened. A large dissecting pseudo-aneurysm was found originating at the site of the previous arteriotomy along the left superficial femoral artery. The pseudo-aneurysm had dissected subcutaneously over the entire left anterior abdomen and flank. The left common iliac artery was surgically divided and both the proximal and the distal ends were oversewn. The clots from the dissecting hematoma were removed, subcutaneous drains were placed in the left flank and the left groin incision was closed. The procedure was extraperitoneal.

Following this fourth operation the patient responded well. Good arterial supply remained in the left thigh to allow healing of the stump. Discharged on September 20, 1963, the patient then remained in good health.

## Comments

The reported mortality from ruptured abdominal aortic aneurysm following operation varies from 34 per cent in one series<sup>2</sup> to 74 per cent in another.<sup>9</sup> Although aneurysmectomy, prosthesis and venorrhaphy of the vena cava are the preferred treatment in this condition,<sup>3</sup> in the present case the anatomical distortion and hemorrhage made vena caval division and ligation necessary. No hypotension ascribable to this procedure was observed.

Certainly one of the known causes for the high death rate in this condition is the development of acute renal failure. Nanson<sup>7</sup> showed that clamping of the abdominal aorta distal to the renal arteries can cause tubular necrosis. Nesbit<sup>8</sup> mentioned that the mortality rate of acute renal failure following prolonged operation approaches 80 to 90 per cent. Barry and associates<sup>1</sup> suggested that acute functional renal failure occurs in all patients undergoing aneurysmectomy.

Both Nesbit and Barry observed that the use of a mannitol infusion early enough can often reverse the process of renal shutdown. This was demonstrated quite dramatically in the present case following the first two operations. Mannitol acts as an osmotic diuretic and is also now thought to increase renal blood flow. Moore<sup>5</sup> recently published a concise review of this subject.

## Summary

A case of an abdominal aortic aneurysm with rupture into the inferior vena cava is reported. It is believed to be the fourteenth case successfully treated surgically. Mannitol was used postoperatively for acute renal failure.

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# Long Term Local Hypothermia of Gangrenous Extremity

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PATIENTS with gangrenous extremities due to vascular insufficiency are in general in poor physiological condition due to age and the advanced state of the arteriosclerotic disease process. Many have diabetes in addition to the widespread arteriosclerosis.

Dehydration, infection and toxemia from the infection about the gangrenous extremity are usual complications. Not infrequently a thromboembolic

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